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Effect of
Plant Spacings
and Fertilizers
on the
Yields of Sorgo



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Effect of Plant Spacings and Fertilizers
on the Yields of Sorgo

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The main objective of these experiments was to see if a reduction in the labor of hand thinning and/or a reduction in lodging could be made by hill planting instead of drill planting. Studies were made at the same time of the interrelationship of fertilizers and plant arrangements to affect sorgo yield.

During the 4 years 1950-1953, several experiments were conducted at the U. S. Sugar Crops Field Station in southwest Georgia (Cairo) in which four plant-spacing arrangements were combined with four fertilizer treatments in a split-plot design. White African and Sart were the varieties used in these experiments.

The four plant arrangements were superimposed on each fertilizer plot. The plant arrangements were: 1 plant every 8 inches (drill), 2 every 16 inches, 3 every 24 inches, and 4 every 24 inches.

The fertilizer treatments were (1) 300 pounds of 6-8-4 (N, P₂O₅, K₂O, respectively), (2) 300 pounds of 6-8-4 per acre, plus 18 pounds of N as side dressing, (3) 300 pounds of 6-8-4 per acre, plus 36 pounds of N as side dressing, and (4) 36 pounds of nitrogen at planting time. Each fertilizer plot consisted of 4 rows with one plant arrangement for each of the rows.

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Because of dry weather and insect damage, some of the experiments were discarded. Six experiments were completed in which White African was grown in 1950, 1951, and 1952, and Sart in 1950, 1952, and 1953. Thus there were three experiments with a midseason variety, White African, and three with a late-maturing variety, Sart.

The sorgo from each row (one plant arrangement) was harvested separately. After removal of the seedhead at the topmost node or joint, the stalks were cut and weighed. A 15-stalk sample was taken from each row, and weighed; the leaves and sheaths were then removed, and the stripped stalks weighed again. These weights were used as a basis for converting the total weight of each plot to obtain the stripped stalk yield. The 15-stalk samples were milled individually in a laboratory mill; the juice was saved and a portion was selected for a Brix (total soluble solids) determination. The remainder was used to form a composite sample of juice from the four plant arrangements of a single fertilizer treatment for cooking a sample of sirup. Cooking was done on a small laboratory-scale sirup evaporator.

Planting was at a much heavier rate than needed so that each treatment could be thinned to the proper stand when the plants were 2 to 3 inches high. It was more difficult to get a perfect stand of the hill plantings than of the drill planting. Insect damage to the seed was probably greater in the hill plantings than in the drill planting. Cultivation was that normally given in good farming. Harvest for sirup production was when the seed were in the soft-dough stage of maturity. Yields of the two varieties were a little below normal for this section because of dry spells.

Results with White African. White African, a midseason variety not well adapted to south Georgia, produces a small yield in comparison to the later-maturing varieties grown under the same conditions. Yield data for White African are given in Table 1. The highest yield of stripped stalks for the plant arrangements was 9.43 tons per acre. This was from the drill planting. The yield of sirup per ton of stalks, however, was the lowest for this spacing. Acre yields of sirup produced from the four spacings varied so slightly that the differences were of no importance.

There were only slight differences in yields of stalks and sirup per acre for the three treatments receiving a complete fertilizer; however, lower yields were obtained from applications of nitrogen alone. Differences in yields of sirup per ton of stripped stalks due to fertilizer treatments were very small and unimportant.

White African matures too early in southwest Georgia to make full use of the entire growing season so does not produce good yields compared to the late varieties. Because this variety does not grow rank, usually there is little or no lodging. However, owing to high winds, in 1951 there was considerable lodging, ranging from 37.4 to 42.2 percent, with no special differences between treatments, either plant arrangements or fertilizers.

The yields for plant arrangement at each fertility level are given graphically in Figure 1. Fertility levels had practically no effect on the acre yields of sirup from the four plant arrangements. Differences due to plant arrangements for any fertility level are minor and of little importance. Side dressings of nitrogen or the treatment of nitrogen alone were ineffective in changing the yield pattern.

Table 1. Results of three White African plant
arrangement-fertilizer experiments
at Cairo, Georgia, 1950-1952

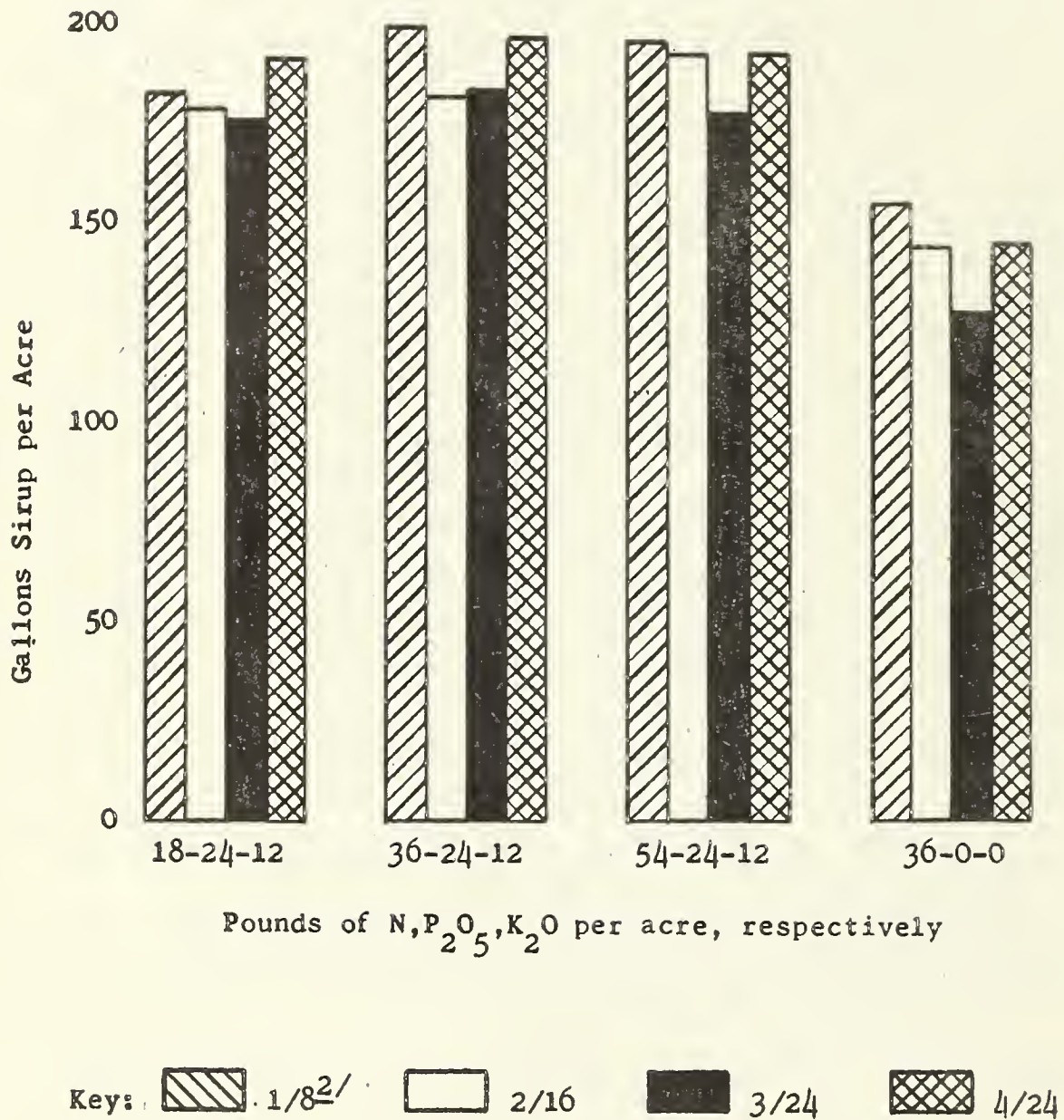
Treatments	Stalks per acre	Sirup yields	
		per ton of stalks	per acre
	Tons	Gallons	Gallons
Plant Arrangements <u>1/</u>			
1/8	9.43	19.8	183
2/16	8.62	20.3	173
3/24	8.19	20.5	165
4/24	9.05	20.4	180
L.S.D. .05	0.81	0.5	N.S.
.01	N.S.	N.S.	N.S.
Fertilizer Treatments <u>2/</u>			
18-24-12	9.22	19.9	180
36-24-12 <u>3/</u>	9.45	20.4	190
54-24-12 <u>4/</u>	9.62	20.1	189
36-0-0	6.99	20.5	142
L.S.D. .05	0.81	N.S.	15
.01	1.08	N.S.	21

1/ "Treatment" shows number of plants/space between plants in inches.

2/ "Treatment" shows pounds of N, P₂O₅, K₂O per acre, respectively.

3,4/ 18 and 36 pounds of nitrogen, respectively, added as side dressing.

Figure 1. Influence of plant arrangements and fertilizer treatments on White African sirup yields at Cairo, Georgia, 1950-52^{1/}



^{1/} Results shown in Table 1.

^{2/} Number of plants/spacing between plants in inches.

The average acre yield of stalks and the yield of sirup per ton of stalks were only slightly influenced by the plant arrangements in the three experiments with White African conducted annually during 1950, 1951, and 1952.

Results with Sart. Sart, a late-maturing variety, was grown in a similar experiment. Yields obtained are given in Table 2. Differences between plant arrangements and between fertilizer treatments were small and not important. Acre yields of stripped stalks varied only 1.17 tons for the plant arrangements and only 1.03 tons for fertilizer treatments. Differences in yields of sirup per ton were extremely small, 0.1 gallon for plant arrangements and 0.5 gallon for fertilizers. Yield of sirup per acre, ranging from 301 to 326 gallons, followed the yield trend of stripped stalks, with small differences between plant arrangements and between fertilizer treatments. In these experiments plant arrangements had no significant influence on acre yields of stalks and sirup or on yields of sirup per ton.

There was no interrelationship between spacing and fertilizers.

The differences for fertilizer treatments were between nitrogen alone and the three complete fertilizers. There was only a very slight difference between the three treatments of complete fertilizers. Side dressings of nitrogen had little effect on acre yields of stalks and sirup, though they did reduce slightly the yield of sirup per ton of stalks.

Lodging did not occur in Sart. This variety is quite resistant to lodging except when winds of gale proportions occur.

The yields of sirup per acre for each plant arrangement at each fertility level for Sart are given graphically in Figure 2. Differences

Table 2. Results of three Sart plant
arrangement-fertilizer experiments
at Cairo, Georgia, 1950-1953

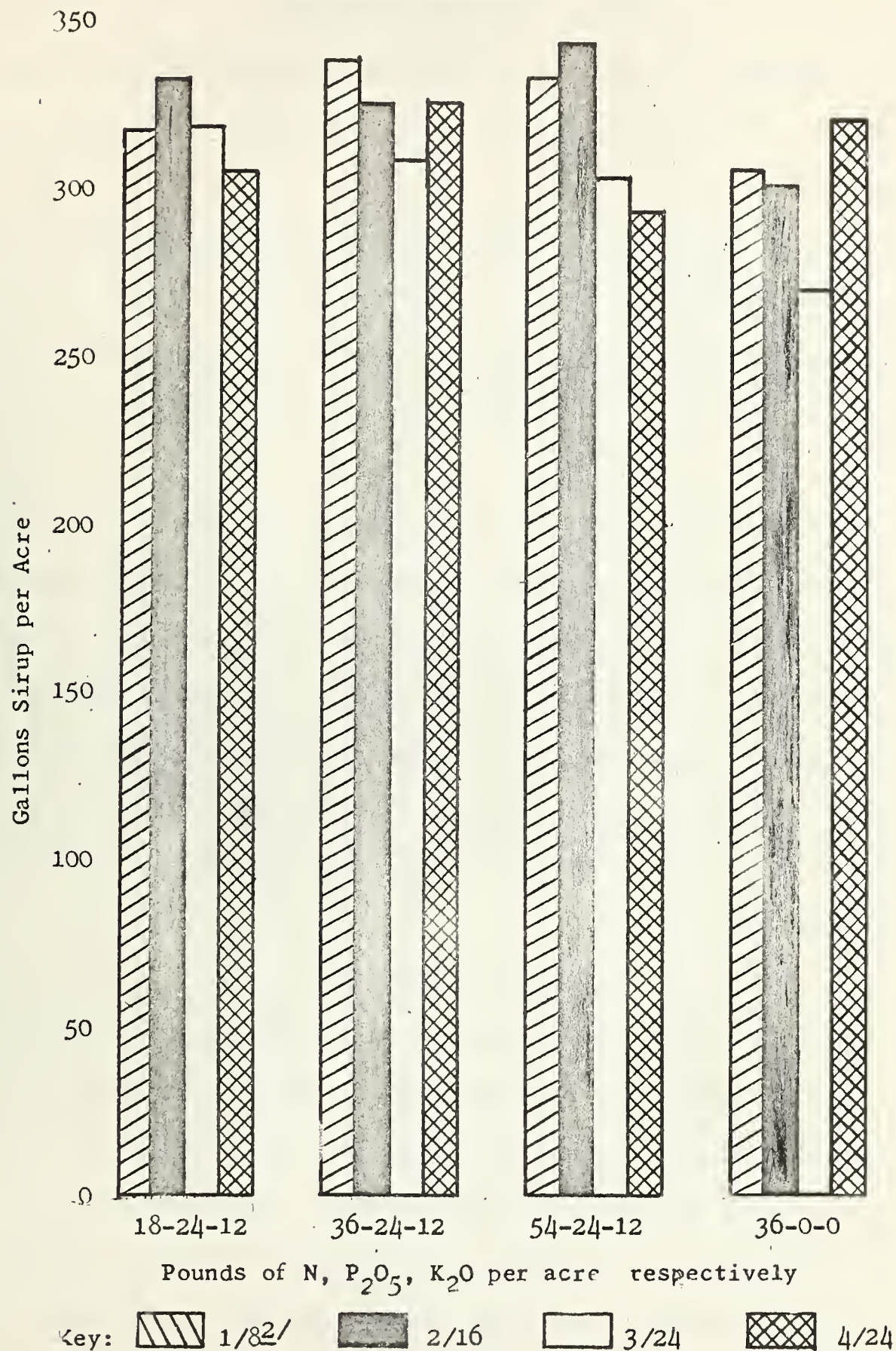
Treatments	Stalks per acre	Sirup Yields	
		per ton of stalks	per acre
	Tons	Gallons	Gallons
Plant Arrangement <u>1/</u>			
1/8	16.21	20.3	326
2/16	16.17	20.4	325
3/24	15.04	20.4	302
4/24	15.49	20.4	313
L.S.D. .05	N.S.	N.S.	N.S.
Fertilizer Treatments <u>2/</u>			
18-24-12	15.78	20.5	320
36-24-12 <u>3/</u>	16.10	20.3	324
54-24-12 <u>4/</u>	16.16	20.0	319
36-0-0	14.86	20.5	301
L.S.D. .05	0.97	0.33	N.S.
.01	N.S.	0.44	N.S.

1/ "Treatment" shows number of plants/space between plants in inches.

2/ "Treatment" shows pounds of N, P₂O₅, K₂O per acre, respectively.

3,4/ 18 and 36 pounds of nitrogen, respectively, added as side dressing.

Figure 2. Influence of plant arrangement and fertilizer treatments on Sars sirup yields at Cairo, Georgia, 1950-53^{1/}



^{1/} Results shown in Table 1.

^{2/} Number of plants/spacing between plants in inches.

in yield for spacing within a given fertilizer treatment are within the limits of experimental error. The use of nitrogen as a side dressing for the crop following a complete fertilizer at planting time, or nitrogen alone at the time of planting, had no effect on yields from the four plant arrangements.

Small differences in acre yields of sirup from Sart, associated with fertilizer treatments, may be due to the late maturity of this variety. Sart and other late-maturing varieties probably utilize more effectively the available soil area than White African and other early-maturing varieties.

Yield data for an additional two experiments with Sart conducted in 1954 and 1955, comparing four plant arrangements at one fertility level, are summarized in Table 3. There was no significant difference in acre yields of stalks and sirup, or in yield of sirup per ton of stalks, for the different plant arrangements. Good stands were secured both years. Lodging was very low both years with no important difference because of treatments. Rainfall was very low in 1954, so the average yield for the two years was low.

Summary of Results

Data from 3 years' experiments with White African and 5 years' experiments with Sart show little difference due to plant arrangements of 1 plant every 8 inches (drill), 2 every 16 inches, 3 every 24 inches, or 4 every 24 inches. Hill plantings have some advantages over drill plantings (single-plant spacing). Less seed is required for planting, and weeds are easier to control because the several plants in a hill form a tuft which

Table 3. Results of two Sart plant
arrangement experiments
at Cairo, Georgia,
1954-1955

Spacing	Lodging	Stalks per acre	Sirup Yields	
			per ton of stalks	per acre
	Percent	Tons	Gallons	Gallons
1/8	3.7	11.43	17.0	185
2/16	3.4	10.69	17.3	174
3/24	4.1	10.42	17.0	168
4/24	3.2	10.74	17.3	178
L.S.D.	N.S.	N.S.	N.S.	N.S.

1954 was the driest year ever recorded at Cairo; yields were very low.

is not so readily covered by soil during early cultivations. The labor for hand thinning is materially reduced in hill plantings.

The fertilizer effect on the yield of sorgo was quite variable. This was due to the fertility level of the soil used for the experiment. Where the land had been well fertilized for previous crops, increases, if any, from fertilizers were small.

Acre yields from plant spacings were not affected by fertilizer treatments. If the yield was low for the treatment of nitrogen alone, it was low for all plant spacings. There was no interaction of fertilizers and plant spacings.

These experiments show that hill plantings produce fully as satisfactory yields as drill plantings (single plant every 8 inches), and require less seed for planting and less hand labor for thinning.

Since dry growing conditions prevailed throughout the period of these experiments, except for 1951, little information on lodging was accumulated. During this one year when lodging did occur in White African, there was no adverse effect from hill plantings.

Information furnished in this report shows that hill plantings, which require less seed, are equal or superior to drill plantings of sorgo for sirup production in southwest Georgia.